Rocky Flats Environmental Technology Site Actinide Migration Evaluation
Meetings July 23-25, 2001
Advisory Group
Greg Choppin, David Clark, David Janecky, Leonard Lane, A J Francis, Annie Kersting

Summary and Recommendations for Path Forward

The AME Advisors see great progress being made in developing the Pathway Report as an integration of the knowledge base and process characterization of actinide migration at RFETS The Pathway Report requires summary diagrams and maps from the Site Wide Water Balance Study for water itself, in addition to actinide contaminants In addition, the report must summarize all the data collected over the years on contamination, before focusing down on a specific set of years

Contaminant source terms, area characteristics, and disturbances in the Industrial Area are fundamentally different than those in the Buffer Zone Therefore, source term/source area characterization efforts must reflect this difference and our path forward must include integration of concurrent D&D and ER efforts and source term characterization Erosion, sediment transport, and actinide mobility modeling capabilities have been advanced by AME for the relatively constant source terms in the Buffer Zone Modeling water and wind erosion and contaminant transport during D&D activities and after Site closure are essential to surface water protection and timely site closure

Progress and Integration

It is noted that tremendous progress has been made over the history of the AME project The KH team has progressed from a Conceptual Model to a detailed Pathway Analysis Report As part of this progress, the team has progressed from use of good scientific judgement and elicitation of expert opinion to the routine use of modern, state-of-the art science and technology This process has nurtured a general change in our fundamental understanding of actinide transport at RFETS Initial discussions focussed on the possibility of plutonium solubility dictated by oxidation state considerations Recent discussions have focused on a more detailed understanding of the intimate role of particulate and colloid-facilitated transport of plutonium and americium at the Site This change in focus and understanding has at times pushed all involved to adopt new modeling approaches to risk assessment (i e erosion and sediment transport), and fundamental understanding as well

The AME Advisors are pleased to see efforts moving from emphasis on an overall conceptual model to a more detailed and scientifically based multi-scale and multi-layer conceptual model

1/8

Results and Discussions

Project Status & Fiscal Year 2002 Work Scope C Dayton (K-H)

An update on the status, planning for funding and project distribution for RFETS AME was presented The erosion modeling, water balance, pathway report and D&D support activities are important ongoing components that are essential to closure of the site The advisors are interesting in seeing the results of continued effort on Pu and Am in water from aseptic wells to complete this pathway component characterization Focused work on colloidal characterization for aseptic well samples and selected surface waters is also important Microbiological processes and transport appear to have been well covered at this time, and without discovery of significant contributions to actinide mobility will be integrated by the ongoing surface water monitoring program

Groundwater Path Forward R. Smith (RMRS)

The report on the Groundwater Path Forward work and the associated discussion focused on problems, which have or could arise in sampling procedures It is difficult to ensure that sampling methods do not result in contamination of the samples It is very important to the performance assessment of the degree of intrinsic water contamination that the samples be retrieved without added contamination from the surface and/or analysis processes

It was discussed how such aseptic sample might be achieved by use of plastic glove boxes surrounding the well head, preventing inclusion of dust from the surface in which the well head is placed A complementary quality assurance approach discussed would involve bringing clean water to the wellhead site and drawing samples from it by the same technique(s) used for well sampling

The discussion provided confidence that the responsible personnel were aware of the importance of "clean" sampling to provide valid data on the level of contamination of the ground water for use in the Pathway report

Biological and microbiological characterization scope, Ward Whicker Comments I. Paton (WWE)

The AME group has considered the comments and suggestions concerning biological processes at RFETS The comments and suggestions were appreciated as being focused and helpful AME Advisors have provided suggestions to the AME group and they are preparing a detailed response to Dr Whickers comments and suggestions

Erosion Modeling – Project Status G Wetherbee (WWE)

Activities using WEPP and the HEC6T models were summarized for the AME Advisory Group Water diversions for the city of Broomfield necessitated reconfiguring the surface water drainage pattern in the models and this was accomplished Future modeling efforts will include the current diversion/drainage patterns

Sediment from roads in the Buffer Zone were previously identified as significant sediment/contaminant source areas However the soil Pu concentrations in the road soil/surface material was extrapolated for sampling sites in undisturbed areas Therefore, surface soil samples were taken in the current road areas and found to have significantly less Pu contamination because the 'clean' road material was emplaced over the contaminated soil Future modeling efforts will incorporate these revised Pu concentration data from the field sampling The WEPP modeling was also done in a scenario where the roads were re-vegetated and currently efforts are being made to simulate the impact on erosion of grass fires

The most significant, and encouraging, development presented was use of the erosion, sediment and contaminant transport modeling capabilities in cooperation with the Land Configuration Design efforts Similar testimony to this overall progress lies in the fact that following the devastating May 2000 Cerro Grande wildfire in and around Los Alamos NM, the WEPP/HEC6T erosion model and approach was transferred to Los Alamos National Laboratory for use in efforts to evaluate the erosion and sedimentation impacts of the fire The Advisory Group appreciates and encourages more of this integration to take full advantage of the advanced erosional and sediment transport modeling capabilities developed for the Site

Pathway Report – Summary Report Comments I. Paton (WWE)

The status of the Pathway Report was presented Drafts of the Summary Report and the Technical Appendices have been completed and review comments were made by the Advisory Group Pathways have been quantified using monitoring data and simulation modeling and these results were used for a preliminary ranking of the relative importance of actinide transport pathways The Advisory Group was pleased to see the quality of the drafts and, with the exception of shallow groundwater transport processes, the completeness of the drafts

Writing the groundwater transport section has been delayed because of delays in development of the Site Wide Water Balance (SWWB) Information from the SWWB is necessary to quantify shallow (Upper Stratigraphic Unit or Alluvial) groundwater interactions with recharge and surface runoff and to quantify subsurface flow and transport rates

Suggestions for a path forward by the Advisory Group include developing a tracking/linking system which couples sections of the Summary Report with the corresponding sections in the Technical Appendix (TA) to enhance quality control and integration This system is needed to ensure that changes in either document are reflected in the other, that the Summary and TA are internally and mutually consistent, and to facilitate the editing processes In addition, this will produce a cross-linked table to assist users of the appendices

D & D Status / Discussion J. Stevens (K-H)

It was clear from discussions with the D&D Team that integration between D&D and ER activities is not only taking place, but that the level of communication and interaction is improving We were very impressed with this integrated approach, which shows clear leadership from the KH teams The D&D activities are making clear progress in their analysis of concrete decontamination, and their development of the understanding of concrete contamination to help guide their decision-making process

Contaminant source terms and areas in the Industrial Area are fundamentally different from those in the Buffer Zone Therefore, source term/source area characterization efforts must reflect this difference and our path forward must include concurrent D&D and ER efforts and source term characterization In the Buffer Zone, disturbances to contaminant source areas are relatively minor and infrequent compared with those in the industrial area For example, such things as construction, excavations, and disturbances from utility repair and maintenance, paving, and vehicle traffic have continually disturbed the physical settings in the Industrial Area These disturbances have made the source terms dynamic throughout the period of Site operations It is critically important that a meta-database of these historical disturbances be developed and used in characterization of contaminant source terms It is also critical that as activities such as excavation of buried pipelines be described in a meta-database including written descriptions, GPS data on the locations for inclusion as a thematic layer in the GIS coverage of the Site, and sampling protocols to characterize location, extent, and form of contaminants Based on the sampling design, soil/contaminant samples should be taken to characterize the known and discovered source terms

Erosion, sediment transport, and actinide mobility modeling capabilities are advanced for the relatively constant source terms in the Buffer Zone Development of this same level of capability for the potentially more significant source terms in the Industrial Areas is dependent upon concurrent D&D, ER, and characterization efforts Modeling water and wind erosion and contaminant transport during D&D activities and after Site closure are essential to surface water protection and timely site closure

Uranium Migration and Background M Murrell (LANL)

The results of high-resolution U isotopic analyses of shallow groundwater and surface water samples from RFETS were presented by Dr Mike Murrell (LANL) In the last two years, over 200 water samples were collected and analyzed for U isotopic ratios and concentrations in order to differentiate between the anthropogenic and natural background uranium concentrations This included blanks and duplicates

Natural U is made up of 3 isotopes, ^{238}U, ^{235}U and ^{234}U The ratios of their abundances are relatively constant When U is processed for use in nuclear weapons and reactors it is enriched, meaning the ratio of $^{235}U/^{238}U$ is greater than the nominal naturally occurring ratio (approximately 0 007253) When U is

4

irradiated in reactors, ^{236}U is also produced Sophisticated analytical methods, such as, high-resolution inductively-coupled mass spectrometry can be used to measure the different isotopes of U in a water sample The presence of ^{236}U can also be measured This information is then used to determine if the U is natural or if it the result of man-made processes

Plotting the isotopic ratios of the water samples, Dr Murrell was able to distinguish anthropogenic from natural U He concluded that the majority of the samples had natural isotopic ratios Dr Murrell was confident that 9 samples had non-natural isotopic ratios and ^{236}U present Four samples may contain non-natural U and the rest had natural U ratios and the presence of ^{236}U was not detected In addition, the concentration of U was not diagnostic in concluding the origin of the U For example, several of the water samples that had approximately natural U isotopic ratios had high concentrations of U (up to 100 ppb) The natural background concentrations of U in and around the RFETS area are heterogeneous This isotopic data is now being mapped and integrated with the compilation of historical uranium usage completed by Laurie Gregory-Frost This information will be extremely useful for future efforts to model the transport of U in surface and shallow groundwater

Texas A & M Work Status P Santschi (TAMU)

Exceedances of Pu concentrations above regulatory limits at GS10 and GS03 appears to be related to particulate and/or colloidal and hot dissolved form Water samples collected during pond release and storm runoff confirm the presence of Pu in both particulate and colloidal forms Pu released from the soil is apparently influenced by the type of dissolved organic carbon and suspended particulate concentration Significant progress has been made through this work, however, some of the initial findings need to be repeated Suggestions of Pu associated with organic colloids needs to be confirmed by more advanced and specific analytical techniques These initial results also suggest the need to investigate the potential role microbes in the watershed and in ponds on the formation or destabilization of colloidal aggregations

Characterization of Pu associated with pseudo colloids (i e Pu associated with organic and inorganic (Fe, Mn, Al- oxides etc)) by the polyacrylamide gel electrophoresis (PAGE) technique is interesting, but needs to be confirmed by other techniques Initial results indicate that Pu is associated with an organic-containing fraction The molecular weight and nature of the organic carbon must be determined Such analyses could include electro-spray mass ionization spectroscopy and EXAFS to confirm the association of Pu with organic or inorganic fractions Identification of the organic material including its source is important to understand the role of organic in the genesis of Pu colloids and/or *in situ* stabilization of Pu

Further studies are needed to confirm the use of U-238/Th-0234 disequilibria measurements to determine the setting of particulates in ponds

Documents Provided to Advisory Group

Fiscal Year 2002 – AME Work Discussion list
AME Group Draft Response to Comments from Ward Whicker
Microbial Characterization of RFETS preproposal from Larry Hersman
Rocky Flats Closure Project – Environmental Stewardship Update Oct 1, 1999 – Dec 31, 2000
Email from Alexander Williams (em doe gov) on Kds and RESRAD modeling
Asbury, S M L , Lamont, S P & Clark, S B (2001) Plutonium partitioning to colloidal and particulate matter in an acidic, sandy sediment Implications for remediation alternatives and plutonium migration Environ Sci Technol 35, 2295-2300
Peter Santschi – Phase Speciation of Pu and Am viewgraphs
Wolfgang Runde – draft memorandum Preliminary studies on plutonium leaching from concrete and soil samples from RFETS
Mike Murrell – Tracing Uranium Migration at the Rocky Flats Solar Ponds viewgraphs
Annie Kersting – Transport of Radionuclides in Groundwater Understanding the Role of Colloids viewgraphs
Ian Paton – Surface Water Pathway Analysis viewgraphs

Documents and Information Requested for Advisory Group

Full list of sample information (e g location labels, locations, depths and stratagraphic unit description) for uranium samples analyzed for isotopic composition
Get pathway report on CD-rom to advisors for comment and editing, build tracking system to enforce consistency between summary and appendices
Electronic file containing Peter Santschi presentation viewgraphs

Requests for Future Presentations and Information

Industrial Area characterization for Environmental Remediation and evolution of the sampling and analysis strategy
Old Process Waste Lines (OPWL) characterization, remediation and D&D strategy and results

6

Participants in AMS technical meetings

Name	Organization
Greg Choppin	FSU
David Clark	LANL
David Janecky	LANL
Leonard Lane	USDA, Tucson
A J Francis	BNL
Annie Kersting	LLNL
Chris Dayton	K-H
Greg Wetherbee	WWE
Russell McCallister	DOE/RFFO
Ian Paton	WWE
Reg Tyler	DOE/RFFO
Mike Peters	RAL
Bob Nininger	K-H
Rob Smith	K-H
John Rampe	DOE/RFFO
David Shelton	K-H
Jeff Stevens	K-H
Peter Santschi	U Texas-A&M
Tom Scott	K-H
Doug Bryant	K-H
Mike Murrell	LANL
Elizabeth Pottorff	CDPHE
Bob Scheck	KH LCDB

Future Meetings

August TBD – Advisors subgroup meeting on Pathway Report comments and editing
October 15-17 – 2002 first quarter site meeting (FY kickoff)
January 7-9 – 2002 second quarter site meeting (Pathway report editing)
April 29-May1 – 2002 third quarter site meeting
July TBD – 2002 fourth quarter site meeting

White Papers planned

XAS primer – modification and update for D&D – Dave Clark
Colloid primer – summary of her stakeholders talk with references, uranium colloid problem scope, and sampling approaches/concerns – Annie Kersting
Characterization of contaminant source terms in the industrial area for transport modeling – Leonard Lane +
Uranium characterization and transport modeling – Pat Longmire

8/8